United States Patent [19]

Couturier

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[54] **AUTOMATIC TRANSFER SYSTEM**

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[73] Assignee: **C. G. Bretting Manufacturing Co.,** Ashland, Wis.

[21] Appl. No.: **40,263**

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[51] **Int. Cl.**[4] **B65B 63/04;** B65B 63/02

[52] **U.S. Cl.** **53/429;** 53/439; 53/530; 493/444

[58] **Field of Search** 53/429, 439, 202, 530, 53/529; 493/444; 414/105, 106

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[57] **ABSTRACT**

A machine for parallel processing a group of clips of stacked interfolded paper sheets having a base, a reciprocating table carrying projectable pins for advancing the group of clips, a clip spreading station for increasing clip-to-clip spacing transverse to the direction of advance of the reciprocating table, a pre-compression station for compressing the clips to a uniform height, a rotation station for selectively rotating each clip 90° length to width, and a folding station having selectively operable opposed blades parallel to the width for forming each clip into a generally U-shaped configuration to fit within a cube-like package.

37 Claims, 5 Drawing Sheets

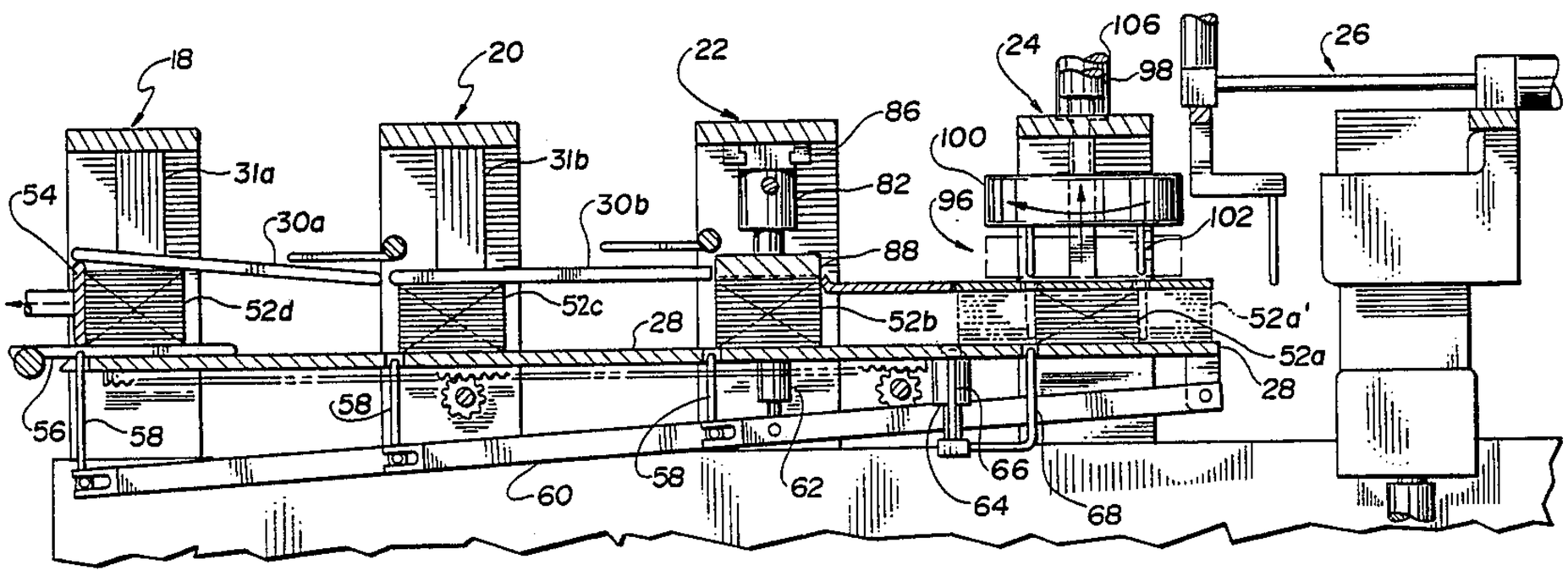


Fig. 4a

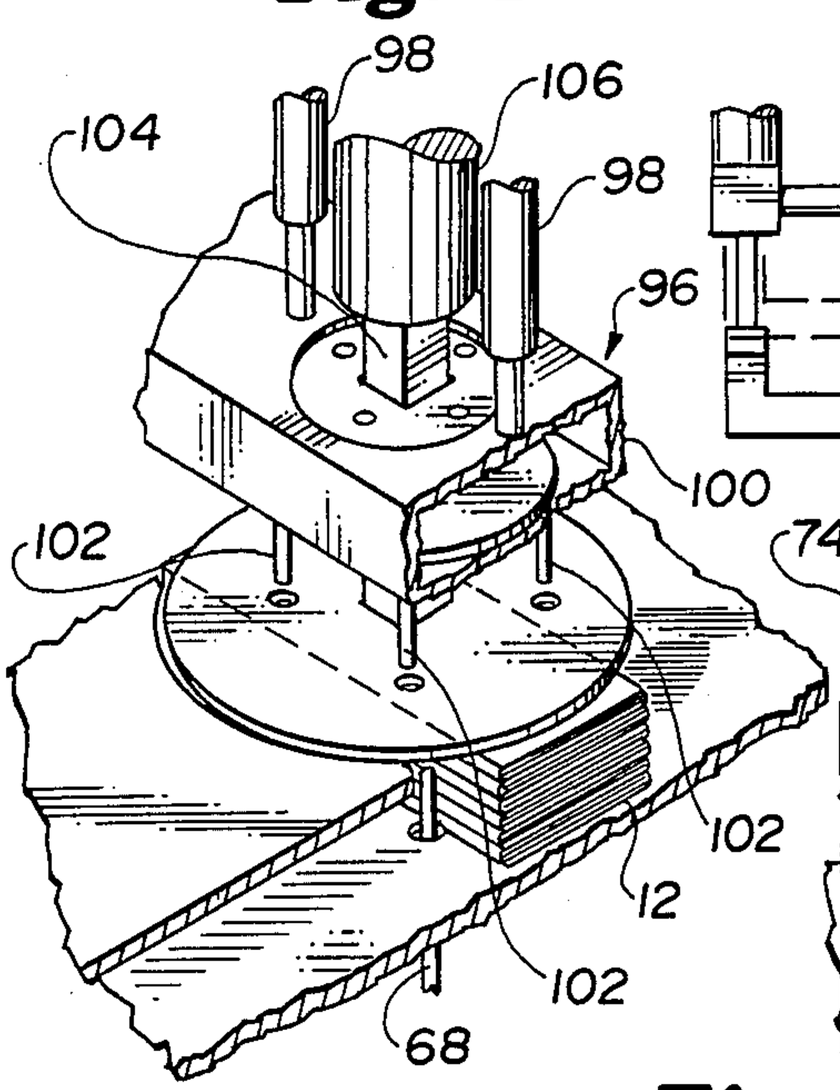


Fig. 8a

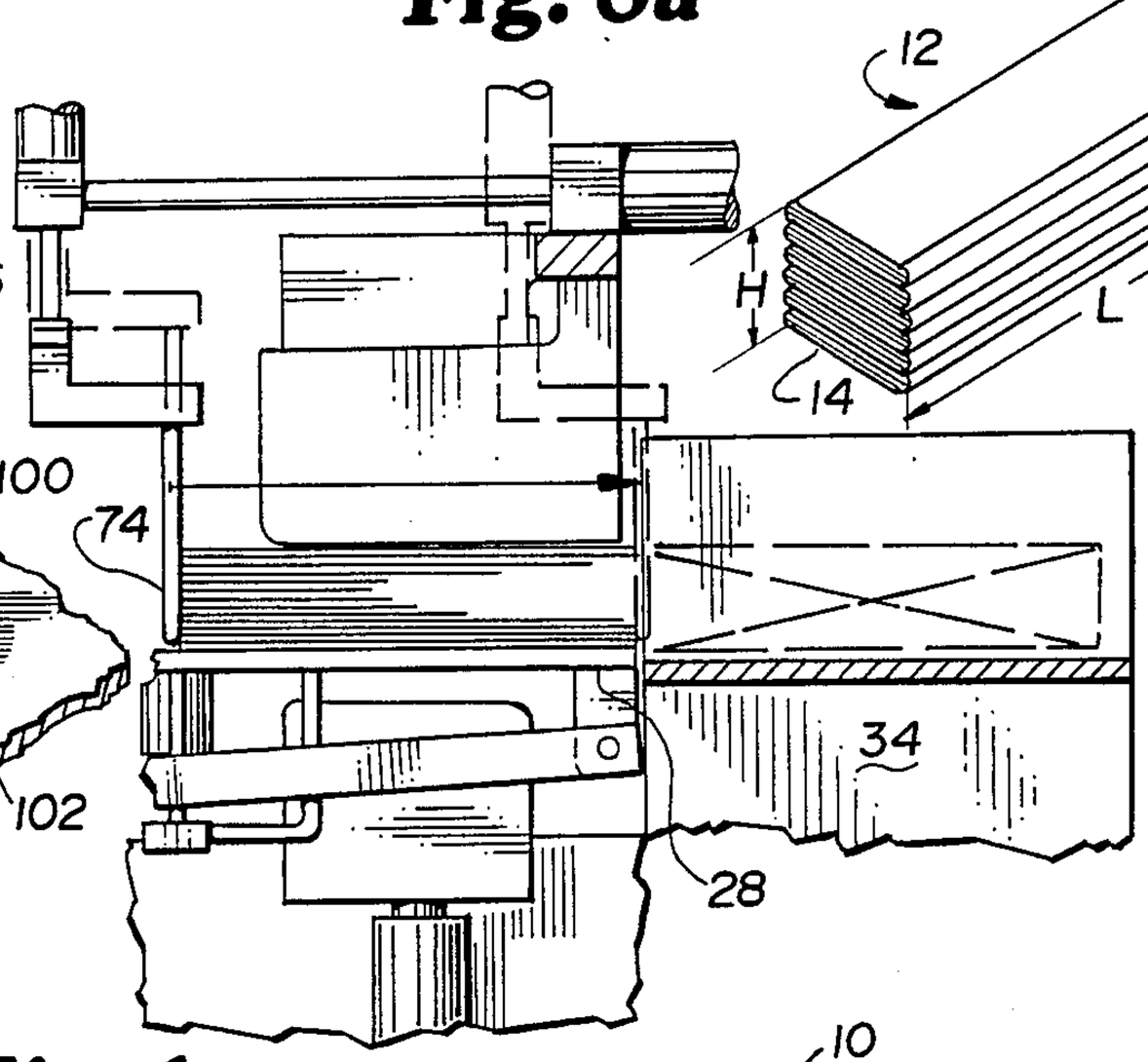


Fig. 1a

Fig. 1

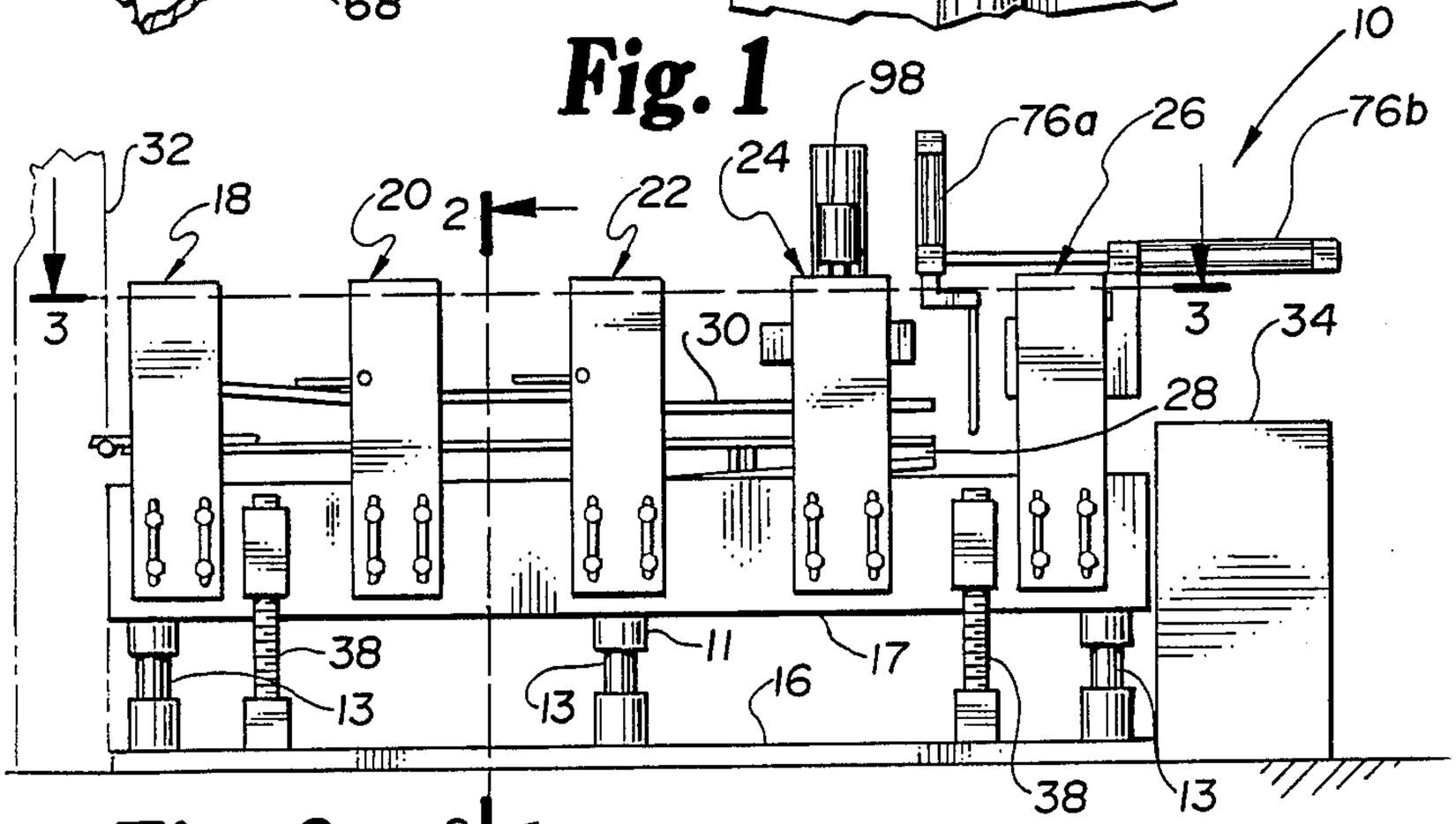
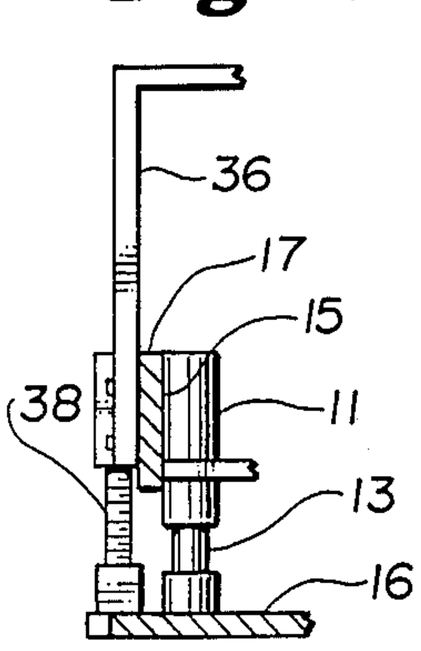
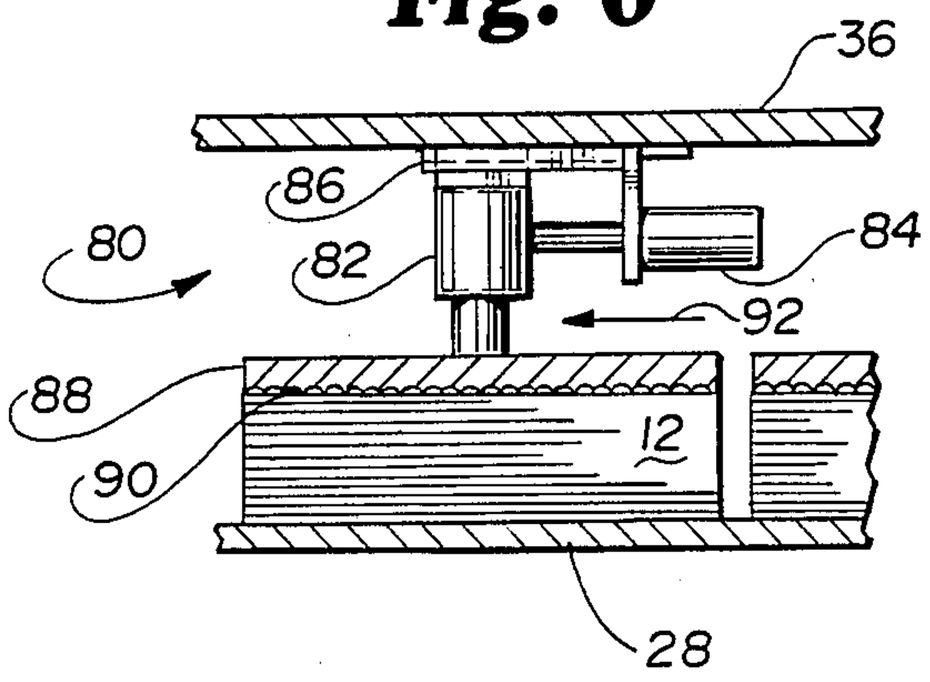
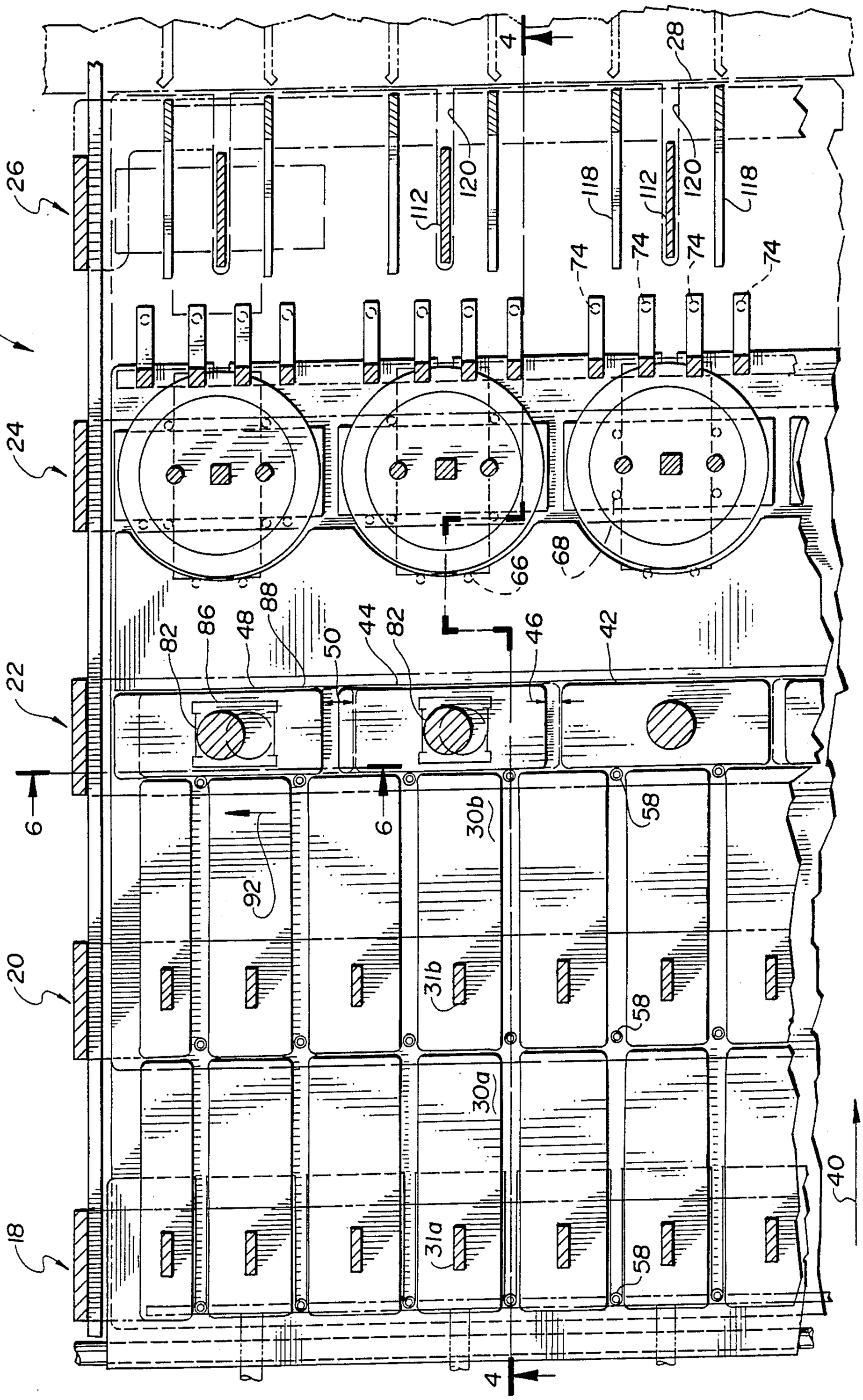


Fig. 2

Fig. 6



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18
20
22
24
26
28
30a
30b
31a
31b
40
42
44
46
48
50
58
68
74
82
86
88
92
96
112
118
120
4
6

Fig. 3

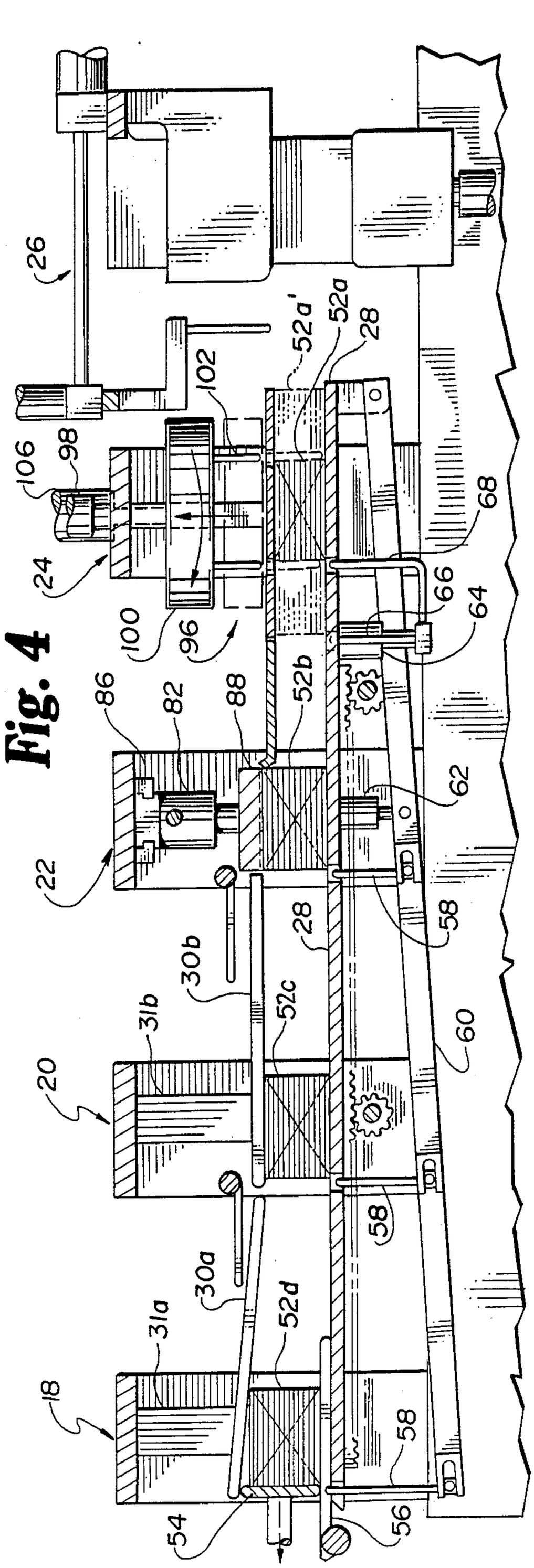
26
102
106
98
24
100
96
52a'
52a
28
68
66
64
52b
86
82
88
62
22
30b
28
58
31b
52c
60
20
30a
31a
52d
58
18
54
56

Fig. 4

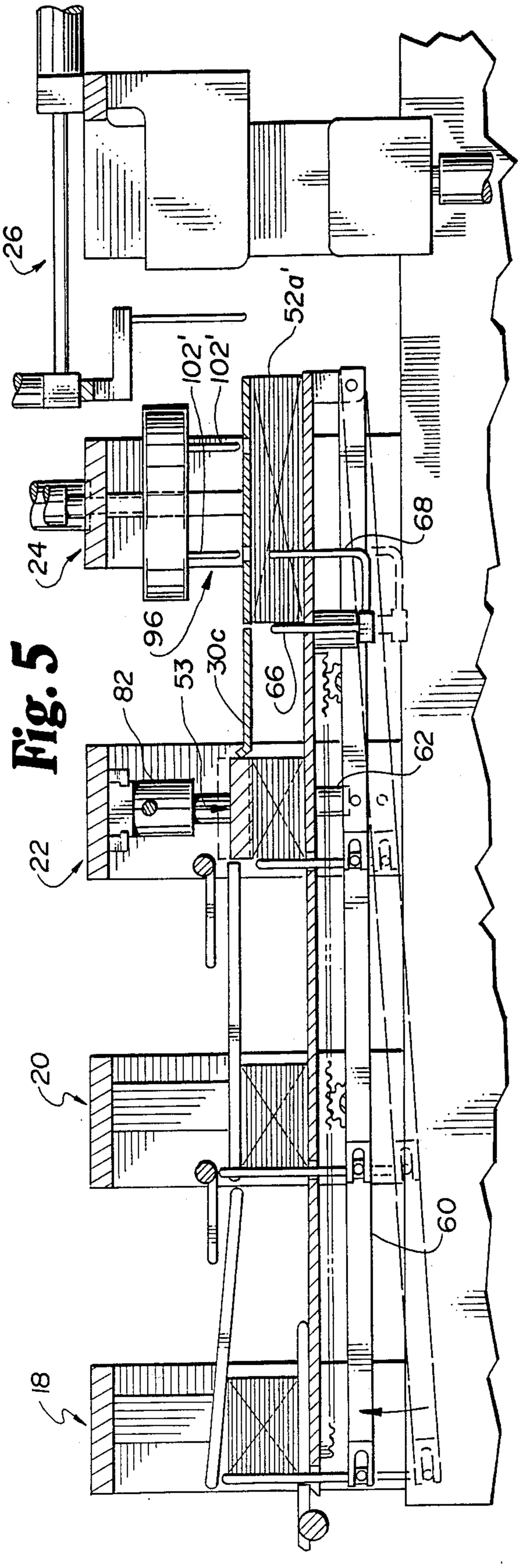
26
102'
102'
52a'
24
96
68
53
30c
66
82
62
22
20
60
18

Fig. 5

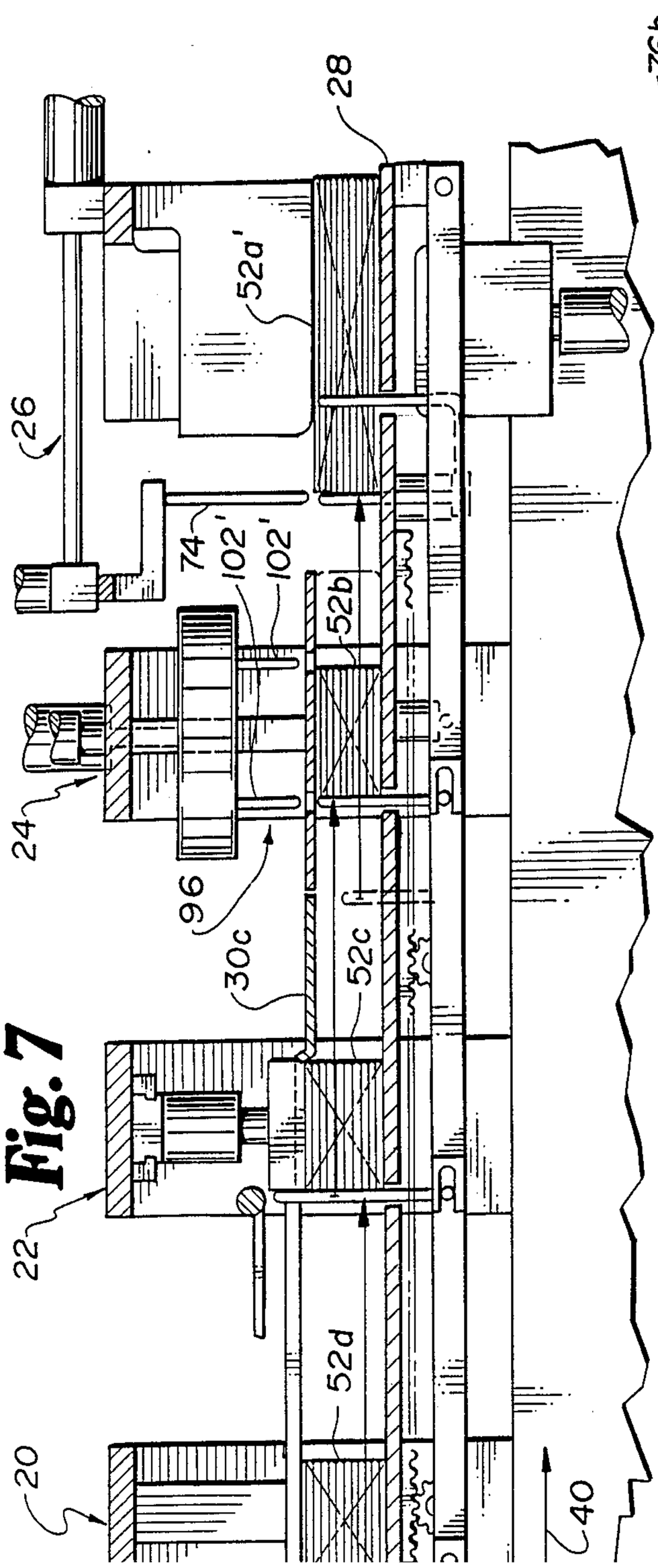
28
52a'
26
74
102'
102'
52b
24
96
30c
52c
22
52d
20
40

Fig. 7

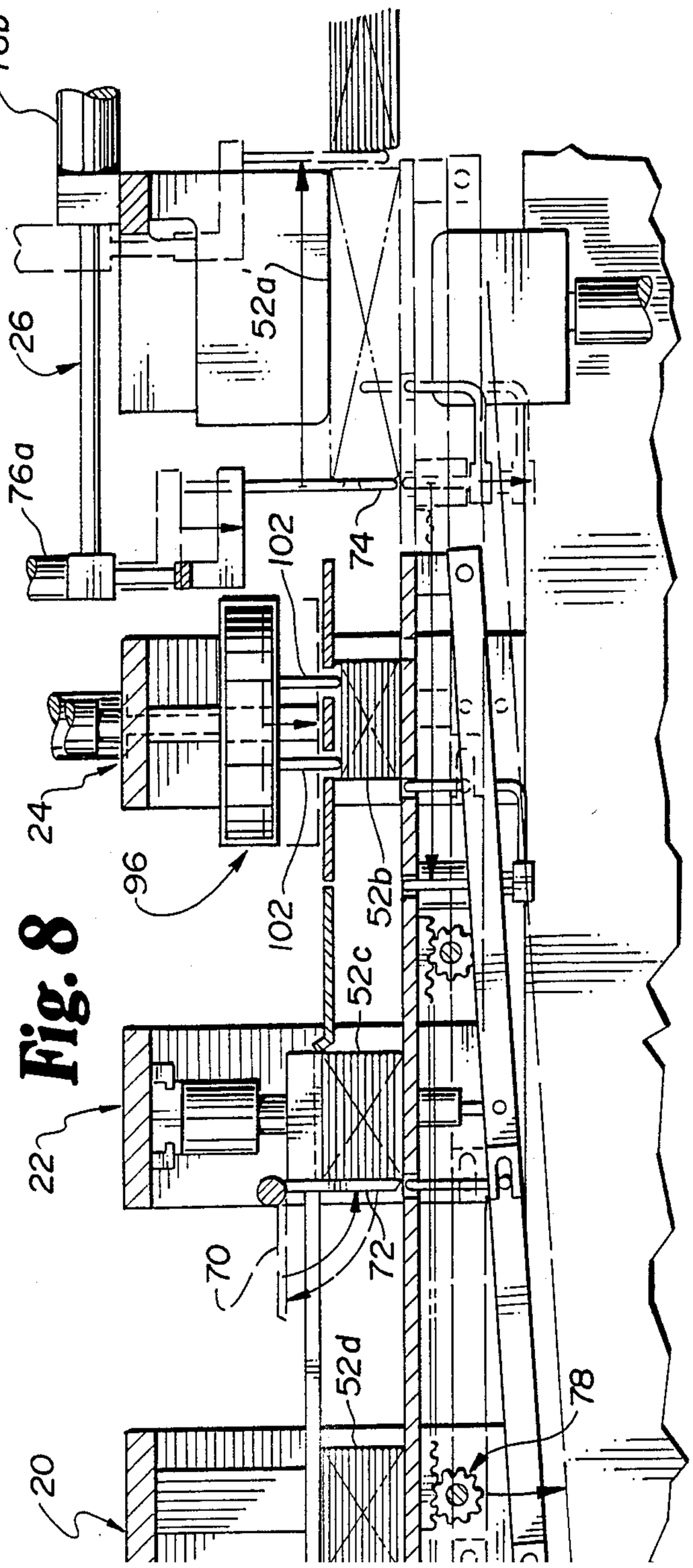
76b
52a'
26
76a
102
74
24
96
102
52b
52c
22
70
72
52d
78
20

Fig. 8

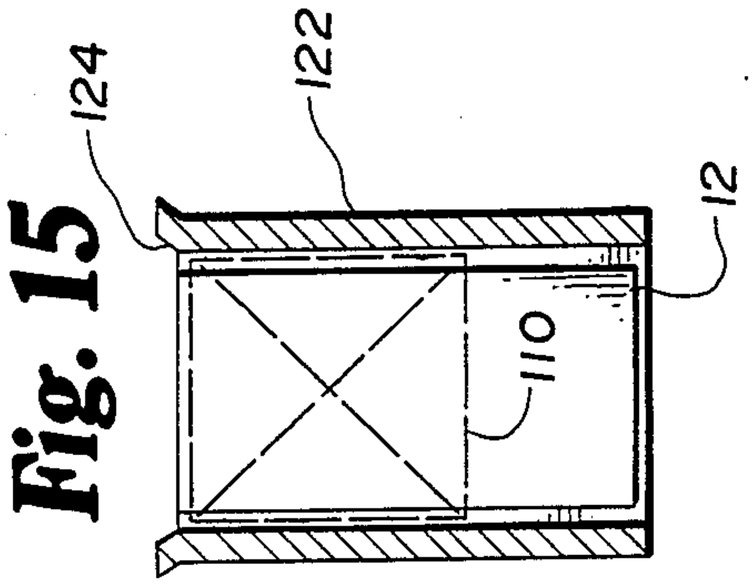

Fig. 15

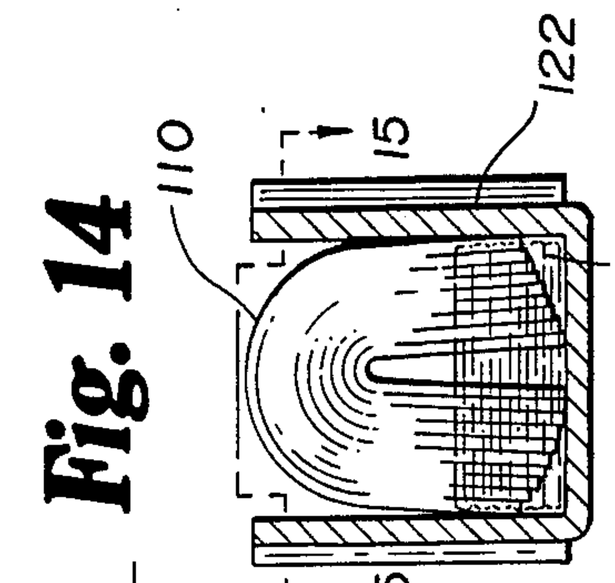

Fig. 14

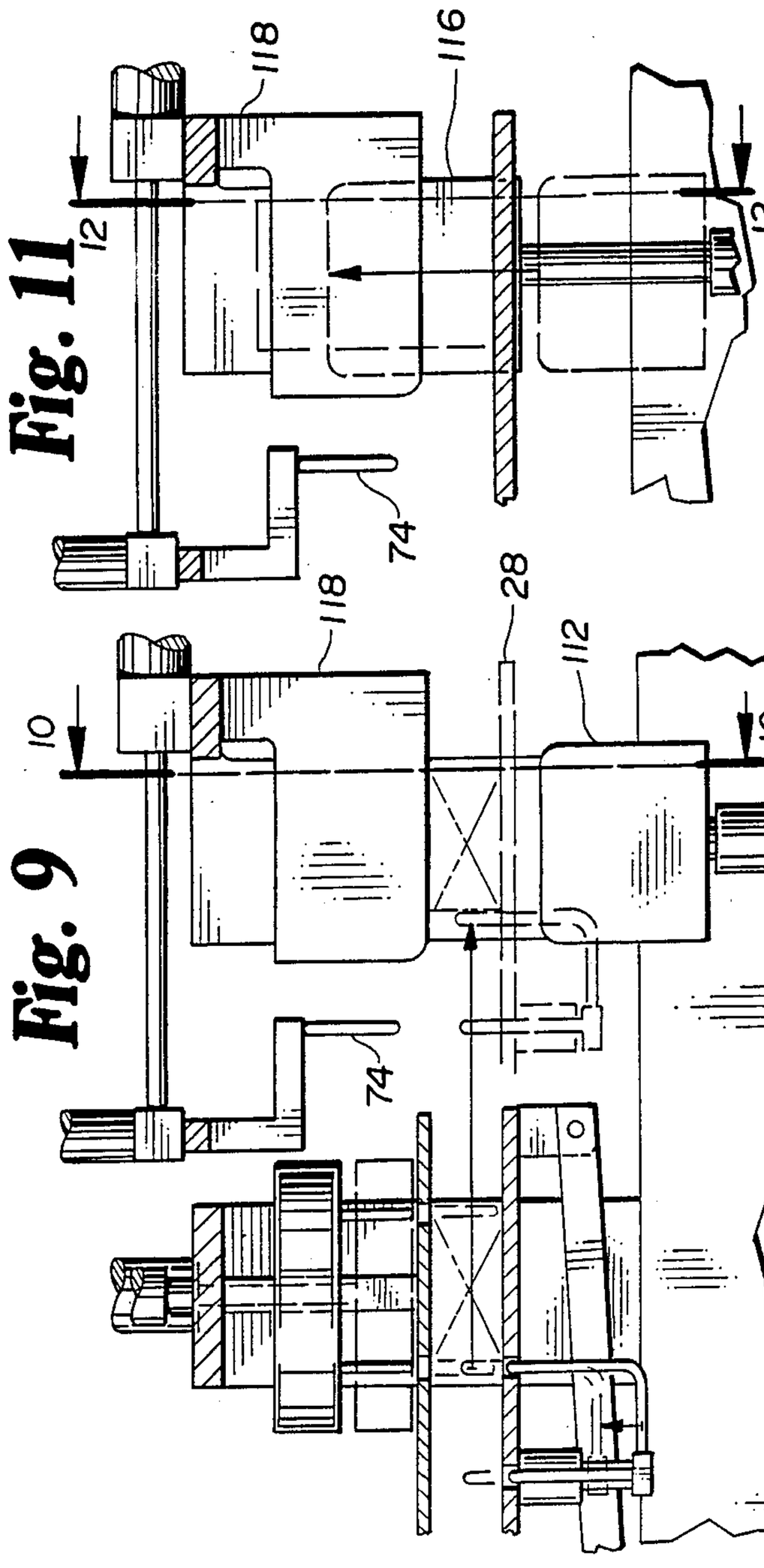

Fig. 11

Fig. 9

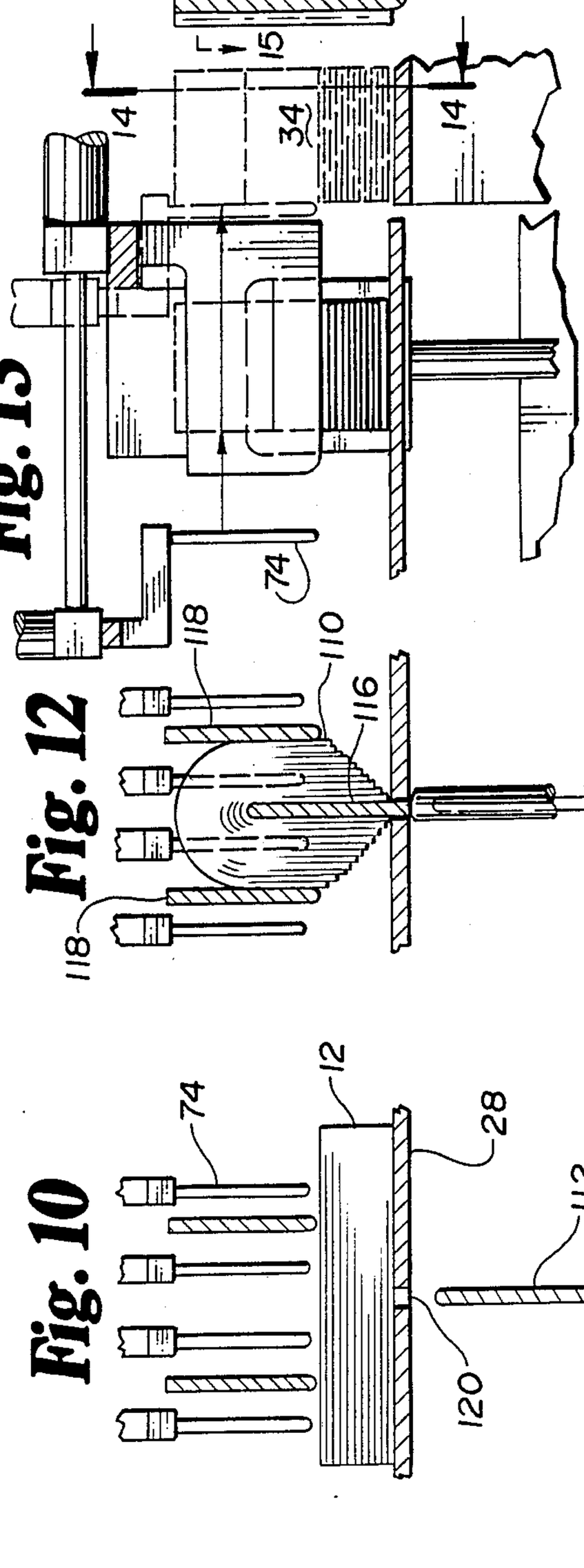

Fig. 13

Fig. 12

Fig. 10

AUTOMATIC TRANSFER SYSTEM

BACKGROUND OF THE INVENTION

With the development of automated machinery such as that which accomplishes interfolding of paper tissues and separation of clips from the stack of such interfolded tissues, and also with the advent of automated machinery for putting such clips of tissues into cartons, it has been found desirable to automate the transfer and processing of such clips as they pass from such interfolding/clip separating machines and such packaging machines.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a right side elevation view of an automatic transfer system or machine of the present invention.

FIG. **1***a* is a perspective view of a clip made up of stacked interfolded paper sheets.

FIG. **2** is a fragmentary section view taken along the line **2**—**2** of FIG. **1**.

FIG. **3** is a top or plan partial section view taken along line **3**—**3** of FIG. **1**.

FIG. **4** is a right side section view taken along line **4**—**4** of FIG. **3** with machine elements shown at the beginning of a clip-advance cycle.

FIG. **4***a* is a fragmentary perspective view of a mechanism for rotating a clip at a rotation station.

FIG. **5** is a view similar to that of FIG. **4**, but with machine elements at a further stage in a clip-advance cycle.

FIG. **6** is a fragmentary section view taken along line **6**—**6** of FIG. **3** showing details of a part of a clip spreader station.

FIG. **7** is a view similar to that of FIG. **5** but with machine elements at a further stage in a clip advance cycle.

FIG. **8** is a view similar to that of FIG. **7** but with machine elements at a further stage in the clip advance cycle.

FIG. **8***a* is a fragmentary section view of the outlet portion of the system showing the discharge of a clip from the system.

FIG. **9** is a fragmentary section view of the last two stations in the system, showing further details thereof.

FIG. **10** is a fragmentary section view taken along line **10**—**10** of FIG. **9** showing details of a clip forming station.

FIG. **11** is a fragmentary section view of the machine elements of the forming station showing the operation thereof.

FIG. **12** is a fragmentary section view taken along line **12**—**12** of FIG. **11**.

FIG. **13** is a view similar to FIG. **11**, showing discharge of a formed clip from the forming station.

FIG. **14** is a section view taken along line **14**—**14** of FIG. **13**.

FIG. **15** is a section view taken along line **15**—**15** of FIG. **14**.

DETAIALED DESCRIPTION

Referring now to FIG. **1**, a machine or automatic transfer system **10** is shown, suitable for parallel processing groups of clips of stacked paper sheets.

Referring now to FIG. **1***a*, an individual clip **12** of interfolded paper sheets **14** is shown. Clip **12** is characterized by an exterior envelope of the form of a rectangular parallelepiped having a height H and, typically, a length L greater than a width W. It is to be understood that clip **12** may be formed of laminar products other than paper, and need not be interfolded for purposes of this invention.

Machine **10** has a frame **11** and is preferably mounted on a base **16** and preferably has a plurality of stations **18**–**26** to be described in more detail hereinafter. Although machine **10** is shown with five stations, it is to be understood that machine or system **10** may have more or less stations depending upon the number of processing steps desired between the input and output. Machine **10** further has a reciprocating transfer table **28** to move groups of clips in a clip-advance cycle from station to station. Machine **10** further has guides **30** which are stationary with respect to base **16**.

Machine **10** is preferably positioned adjacent to and downstream of a sheet interfolding and clip separating machine **32** which provides successive groups of clips to input station **18**. Machine **10** is further preferably adjacent to and upstream of further processing machinery **34** which may, for example, be a conveyor to feed a packaging or cartoner machine to package individual clips processed by machine **10**.

Referring now to FIG. **2**, stations **18**–**26** are each preferably mounted on inverted U channel member **36** and are adjustable as a set with respect to base **16** by screw jacks **38** which are preferably interconnected together to be simultaneously operable through a shared drive means, which, for example may be a chain drive linking height adjusting nuts on screw jacks **38** (not shown). It is to be understood that once individual stations are properly installed and adjusted screw jacks **38** change the height of guides **30** and stations **18**–**26** all together with respect to table **28** (which is mounted for reciprocation with respect to frame **11**) to accommodate differing heights of clips **12**. This has been found useful in accommodating different counts of sheets which are interfolded into clip **12**; for example machine **10** may be adjusted from 100 count to 200 count clips simply by one adjustment controlling all screw jacks **38** simultaneously. Frame **11** is preferably supported by rigid legs **13**. A sliding interface **15** between a rail **17** (to which members **36** are attached) and frame **11** permits such adjustment.

It is to be further understood that since each station is mounted by its own channel member **36**, individual stations are modular in that they are individually replaceable for maintenance purposes without disturbing adjustment of other stations. Such modularity permits a degree of interchangeability of parts and a reduction in the number of spare parts required to be kept on hand. Additionally, if future improvements are desired to be made to system **10**, such modularity permits a greater degree of flexibility in installing such improvements. For example, it may be found to be desirable to further process the top layer of the group of clips passing station **20**, and in such event, additional machinery may be installed at station **20** without disturbing the remainder of system **10**.

Referring now to FIG. **3**, machine **10** is designed to receive and process a plurality or group of clips, moving them from station to station in a direction of advance **40** through machine **10**. To illustrate certain aspects of this machine, a portion of the machine which is capable of handling a group three clips wide is shown,

however it is to be understood that any number of clips in a group may be appropriately handled.

As a group of clips is received by machine **10**, it enters input station **18**. It is to be further understood, that as clips are received at input station **18**, they are commonly adjacent each other in their respective group, and may in fact be somewhat interleaved at adjacent edges within the group as a result of the interfolding process which may interfold a group of clips in parallel. Such interleaving is undesirable since it interferes with further processing of the clips. A spreader station **22** increases the clip-to-clip spacing transverse to the direction of advance **40** such that clips in a particular group are more widely spaced upon leaving than they were upon entering machine **10** at input station **18**. This is accomplished by clamping against each clip in the group then at station **22** and transversely driving adjacent clips in that group a desired distance apart, as illustrated in FIG. **3**, where the clip at position **42** is not transversely moved, while a clip at position **44** is transversely moved a distance **46** and a clip at position **48** is transversely moved a distance **50**.

Machine **10** also preferably includes a rotation station **24** which will rotate individual clips 90° such that the clip length dimension is oriented from perpendicular to parallel to the direction of advance **40**. It is to be understood that this step of rotating the clips is optional, and it is dependent upon which orientation the clips are desired to be in upon exiting system **10**.

Referring now to FIG. **4**, table **28** extends beneath input station **18**, pre-compression station **20**, spreader station **22**, and rotation station **24** at the beginning of a clip advance or transfer cycle. In FIG. **4**, four groups of clips **52***a–d* are shown. The last group of clips to be loaded into machine **10** is group or plurality **52***d* which has been loaded by pusher **54** from a preceding machine. In the event that group **52***d* is defective, it may be dumped by pivoting reject gate **56** which eliminates unnecessary further processing of defective groups of clips.

Guides **30**a,b are secured to channel **36** by respective ribs **31***a,b*. Pre-compression station reduces the height of a group of clips by pre-compressing the clips in that group by operation of guides **30***a,b*. It is to be understood that clips progressing from station **18** to station **20** may contain entrapped air which will be expelled by such pre-compression

Referring now also to FIG. **5**, the first step in a clip advance cycle is to raise a plurality of draw pins **58** such that pins **58** project through table **28** adjacent clips **52**. Pins **58** are preferably raised by bar **60** driven by actuator **62** which may be a hydraulic or pneumatic cylinder. Depending upon the orientation of the clips in group **52***a*, auxiliary cylinder **64** may also be actuated, raising pins **68**.

Referring now also to FIG. **7**, table **28** advances a distance equal to the station-to-station distance in the direction of advance **40** moving each group of clips forward one station. In FIG. **7**, the furthest processed group of clips **52***a*′ is shown as having been rotated at rotation station **24** before being advanced to forming station or position **26**. Table **28** is now in the advanced position.

Referring now also to FIG. **8**, pins **58** are retracted below table **28** as are pins **68** if necessary, stripper pins **70** are actuated to position **72**, and group **52***a* is ejected from system **10** by ejector pins **74** being actuated downward and rightward by cylinders **76***a,b*. It is to be understood that this processing shows an operation with clip rotation at station **24** but without clip forming at station **26**, discharging "flat grade" or unformed clips to conveyor **34**.

With pins **70** in position **72** and pins **58** and **68** retracted below table **28**, table **28** is itself retracted to the position shown in FIG. **8**, which corresponds to that in FIG. **4**. It should be noted, however, that groups of clips **52***a–d* have been advanced one station, and meanwhile a new group of clips **52***e* has been received at input station **18**. Table **28** may be advanced and retracted by a rack and pinion drive **78** or other suitable means, such as air cylinders.

Referring now also to FIG. **6**, a more detailed view of the structure of one fixture in the spreader station is as follows. A clip spreader assembly **80** is mounted on channel **36** at station **22**. Assembly **80** includes a first actuator **82** and a second actuator **84**, which may be pneumatic air cylinders. Actuator **84** is rigidly secured to channel **36**, while actuator **82** is mounted for sliding movement with respect to channel **36** by track **86**. A serrated or scalloped clamp plate **88** is mounted to actuator **82**. Serrations **90** provide a surface texture for plate **88** aligned with the direction of advance **40** to permit relative ease of entry and exit of clip **12** into and out of spreader station **22** while providing a sufficient gripping force on clip **12** transverse to direction **40**. Serrations **90** have been found useful for driving clip **12** laterally in direction **92**, transverse to the direction of advance **40**.

The operation of spreader station **22** is as follows. As a result of a clip advance cycle, group of clips **52***c* is transferred to spreader station **22** as in FIG. **7**. Actuator **82** drives plate **88** against each clip **12** in group **52***c*, as shown by arrow **53** in FIG. **5**. Next, actuator **84** drives adjacent clips **12** in group **52***c* laterally in the transverse direction **92**, as shown in FIG. **3**. It is to be understood that one clip in the group need not be driven transversely. Once spread, the clips in group **52***c* are held compressed by plate **88**, until the next clip advance cycle moves group **52***c* out of station **22** and under guide**30***c*. After release of the spread clips, assembly **88** retracts to a starting position indicated in FIG. **7** showing retraction of plate **88** in the clip-height direction. Actuator **84** also retracts plate **88** in the lateral direction opposite to arrow **92** to a ready position for a new clip spreading cycle on group **52***d* when that group is received at spreader station **22**.

Referring now also to FIG. **4***a*, the structure and operation of rotation station **24** is as follows. FIGS. **4** and **8** show a preferred embodiment and FIGS. **5** and **7** show an alternative embodiment for rotation pin assembly **96**. One or more actuators **98** are adapted to drive pin carriage **100** up and down to raise and lower pins **102** against each clip **12** in the group then at station **24**. In FIG. **4**, group **52***a* is the group of clips then at station **24**. Actuating pin carriage **100** causes pins **102** to engage the top surface of the clip, as shown in FIG. **8**. In an alternative embodiment, pins **102**′ may be more widely spaced as shown in FIGS. **5** and **7** to engage the sides of each clip then present at station **24**. In either event, pins **102** drive clip **12** rotationally to a position **52***a*′ as shown in FIGS. **4** and **5**. Rotation is accomplished by rotating carriage **100** through shaft **104** driven by an actuator **106** which may be a rack and pinion driven by an air cylinder, an electric or pneumatic angular positioning motor, or other conventional means. It is to be understood that rotation of clips **12** at this station is optional, depending upon the desired orientation of clips to be

further processed, and also that hold-down pins **102** serve the function that stripper pins would serve at this station, i.e., pins **102** retain the clips then present at station **24** while table **28** is retracted as shown in FIG. **8**.

Referring now also to FIG. **8***a*, if the clips in rotated group **52***a'* are not needed to be further processed, they are ejected by ejector pins **74** to conveyor **34** while table **28** is in the advanced position as shown in FIG. **8***a*.

Referring now also to FIGS. **10–15**, the structure and operation of forming station **26** may be seen. FIG. **10** shows an unrotated clip **12** received at forming station **26** on table **28**. If it is desired to form clip **12** into a generally U-shaped configuration **110**, blade **112** is actuated by an actuator **114** (which may be an air cylinder) to position **116**, forming clip **12** into configuration **110** by forming clip **12** between blades **116** and **118**. Table **28** has slots **120** (which may be seen more clearly in FIGS. **3** and **10**) to accommodate blades **112**. After clips have been formed into the U-shaped configuration, ejector pins **74** transfer the clips of the group then at forming station **26** to conveyor **34**.

It is to be understood that, while it is preferable that clip spreading, rotation and forming all take place with table **28** in the advanced position, other timing of station activity with respect to table reciprocation is within the contemplation and scope of this invention.

Conveyor **34** carries magazines as shown in FIGS. **14** and **15**, to receive formed or unformed clips. Magazine **122** preferably a two-sided structure having a flared inlet **124** for receiving either an unformed clip **12**, or a formed clip **110**. Conveyor **34** then carries that group of clips away and presents a new group of empty magazines **122** adjacent forming station **26** at the time pins **74** are ready to eject a new group of clips from that station.

The invention is not to be taken as limited to all of the details thereof as modifications and variations thereof may be made without departing from the spirit or scope of the invention; accordingly,

What is claimed is:

1. An automatic transfer system for parallel processing a group of clips of stacked laminar products comprising:

(a) a machine frame having:

(i) a base, and

(ii) advancing means mounted on said base having reciprocating means carrying selectively projectable pins for periodically advancing a group of clips; and

(b) a clip spreading station having:

(i) spreader means for increasing clip-to-clip spacing transverse to the direction of advance of said advancing means such that the clips in a group are more widely spaced upon leaving than upon entering said system.

2. The system of claim **1** wherein said folding means further comprises opposed blades parallel to said width, with relative movement of a first blade intermediate a pair of second blades such that said clip is formed into the U-shaped configuration when said first and second blades are drawn together.

3. The system of claim **1** wherein said spreader means comprises a plate for each clip having a surface texture with relatively lower friction in the direction of advance and a relatively higher friction transverse to the direction of advance.

4. The system of claim **3** wherein said spreader means further comprises transverse drive means for driving at least one plate transverse to the direction of advance.

5. The system of claim **4** wherein said transverse drive means comprises a selectively actuable air cylinder.

6. The system of claim **1** further comprising:

(c) a pre-compression station positioned before said clip spreading station and having pre-compression means for receiving clips of varying heights and for compressing said clips to a pre-compression uniform height.

7. The system of claim **6** wherein said pre-compression means comprises guide rails positioned with respect to said advancing means in a spaced relationship which tapers from a relatively wide to a relatively narrow spacing in the direction of advance of said advancing means.

8. The system of claim **6** wherein said clip spreading station further comprises:

(ii) compression means for further compressing said clips from said pre-compression height to a final clip height.

9. The system of claim **8** wherein said compression means comprises an air cylinder operable in the clip height direction.

10. The system of claim **1** wherein said clips are generally rectangular with length unequal to width, said system further comprising:

(d) a rotation station having selectively operable rotation means for rotating each clip generally **90°** such that each clip is reoriented length to width.

11. The system of claim **10** wherein each said station is modular and individually replaceable without disturbing other stations in said system.

12. The system of claim **1** wherein said clips are non-cubic rectangular parallelepipeds with length greater than width, said system further comprising:

(e) a folding station having selectively operable folding means for forming each clip into a generally U-shaped configuration such that each formed clip will fit within a rectangular package whose edge dimension is generally equal to the smaller of the unformed clip width.

13. A method of longitudinally advancing and positioning successive groups of clips of stacked laminar products from an input station to an output position and transversely spreading the clips in each group by moving said clips in groups from station to station comprising:

(a) reciprocating a table in a direction of advance from a first position to a second position such that said table stops adjacent a plurality of stations at each of said first and second positions;

(b) reciprocating a plurality of pins generally orthogonal to said table such that:

(i) said pins project from the plane of said table when said table moves forward in the direction of advance, and

(ii) said pins are recessed below the plan of said table when said table moves backward against the direction of advance; and

(c) spreading the clips in a particular group while that group is at a spreader station such that the clip-to-clip separation in a direction transverse to the direction of advance is increased.

14. The method of claim **13** further comprising:

(e) forming each clip in a group then present at a forming station into a generally U-shaped configuration such that the effective length of each clip in that group is substantially lessened.

15. The method of claim 13 wherein said spreading step further comprises:

(c1) clamping a plate against each clip in that group;

(c2) driving at least one plate transversely to the direction of advance to spread the clips in that group; and

(c3) retracting said plates to an unclamped and unspread position.

16. The method of claim 13 further comprising:

(d) rotating each clip in a particular group while that group is at a rotating station such that each clip in that group is rotated length for width relative to the direction of advance.

17. The method of claim 16 wherein said rotating step further comprises:

(d1) extending clamping means against each clip at the rotating station in a direction towards said table;

(d2) rotating each clip at the rotating station substantially 90° by driving through said clamping means; and

(d3) retracting said clamping means to an unextended position.

18. The method of claim 17 wherein said clamping means comprises a set of pins projecting into the top surface of each clip at the rotating station.

19. The method of claim 17 wherein said clamping means comprises a set of pins projecting along side of each clip at the rotating station.

20. The method of claim 14 wherein said forming step further comprises:

(e1) projecting a first blade transverse to the length of the clips at the forming station generally at the mid point of each such clip;

(e2) opposing the projecting of said first blade by a pair of opposed second blades transverse to said clip length and spaced substantially equidistant from said first blade by half the desired effective length of said formed clip such that second blades are exterior of, and said first blade is interior of, the U-shaped configuration;

(e3) moving each said formed clip out of said forming station; and

(e4) retracting said first blade.

21. The method of claim 20 wherein said forming step occurs while said table is in said forward position.

22. A machine for transferring and processing clips of interfolded paper sheets comprising:

(a) a base;

(b) transfer means adjustably mounted on said base for advancing a plurality of clips from station to station;

(c) an input station mounted on said base for receiving a plurality of adjacent clips;

(d) a pre-compression station mounted on said base for reducing the height of said clips below that at said input station;

(e) a spreader station mounted on said base for providing separation among said plurality of clips;

(f) a rotation station mounted on said base for selectively rotating each clip then at that station 90°; and

(g) a forming station mounted on said base for selectively forming each clip then at that station into a U-shaped configuration.

23. The machine of claim 22 wherein said stations are modular such that each such station may be removed without disturbing other stations of said machine.

24. The machine of claim 22 further comprising height adjustment means for simultaneously adjusting the clearance between said stations and said station transfer means for various heights of clips resulting from various counts of paper sheets in said clips.

25. The machine of claim 24 wherein said height adjustment means comprises a plurality of screw jacks simultaneously adjustable through a shared drive means.

26. The machine of claim 22 wherein said transfer means advances and retracts with respect to said stations and further comprising retention means at said pre-compression and rotation stations for retaining the clips at those stations as said transfer means retracts.

27. An automatic transfer system for parallel processing a group of clips of stacked laminar products comprising:

(a) a machine frame having:

(i) a base, and

(ii) advancing means mounted on said base for periodically advancing a group of clips; and

(b) a clip spreading station having:

(i) spreader means for increasing clip-to-clip spacing transverse to the direction of advance of said advancing means such that the clips in a group are more widely spaced upon leaving than entering said system

wherein said spreader means comprises a plate for each clip having a surface texture with relatively lower friction in the direction of advance and a relatively higher friction transverse to the direction of advance.

28. The system of claim 27 wherein said folding means further comprises opposed blades parallel to said width, with relative movement of a first blade intermediate a pair of second blades such that said clip is formed into the U-shaped configuration when said first and second blades are drawn together.

29. The system of claim 27 herein said spreader means further comprises transverse drive means for driving at least one plate transverse to the direction of advance.

30. The system of claim 29 wherein said transverse drive means comprises a selectivey actuable air cylinder.

31. The system of claim 27 further comprising:

(c) a pre-compression station positioned before said clip spreading station and having pre-compression means for receiving clips of varying heights and for compressing said clips to a pre-compression uniform height.

32. The system of claim 31 wherein said pre-compression means comprises guide rails positioned with respect to said advancing means in a spaced relationship which tapers from a relatively wide to a relatively narrow spacing in the direction of advance of said advancing means.

33. The system of claim 31 wherein said clip spreading station further comprises:

(ii) compression means for further compressing said clips from said pre-compression height to a final clip height.

34. The system of claim 33 wherein said compression means comprises an air cylinder operable in the clip height direction.

35. The system of claim 27 wherein said clips are generally rectangular with length unequal to width, said system further comprising:

(d) a rotation station having selectively operable rotation means for rotating each clip generally 90° such that each clip is reoriented length to width.

36. The system of claim **35** wherein each said station is modular and individually replaceable without disturbing other stations in said system.

37. The system of claim **27** wherein said clips are non-cubic rectangular parallelepipeds with length greater than width, said system further comprising:

(e) a folding station having selectively operable folding means for forming each clip into a generally U-shaped configuration such that each formed clip will fit within a rectangular package whose edge dimension is generally equal to the smaller of the unformed clip width.

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